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AUTHOR Jain, Sushil K.
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ABSTRACT

This overview of the issues involved in introducing educational computing into a school system at either the district, building, or classroom level begins by defining the terms "educational computing" and "computer literacy." A discussion of the curriculum development process focuses on the role of educational technologies in the curriculum, and the current status of computer literacy education in Ontario public schools is briefly described. Guidelines developed by the province of Ontario for computer use in publicly-funded schools are noted. In response to the provincial philosophy on computer use in elementary and secondary education, a set of educational objectives for computer literacy and a description of a "typical" computer literacy course for fifth grade students are provided. The document also considers three issues that teachers will have to face when implementing a computer literacy program--hardware selection and other technical needs, software selection, and physical arrangements. (26 references) (GL)

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Educational Computing in Schools

By

S. K. Jain

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Educational Computing in Schools by **Sushil K. Jain**

Assignment:

Imagine you have been given the task of introducing educational computing into a school system at either the district, building, or classroom level. Assume you have been given a realistic budget to begin the implementation. Discuss one or more significant issues you will need to address as you begin to implement computers into the curriculum. Explain the implications of each issue for the setting you have selected and possible courses of action.

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This assignment can be answered by discussing and coming to an understanding of the following points:

1. What is educational computing? Is this the same as computer literacy? Definition of computer literacy.

2. Introduction of curriculum at the district level has to be done by the board and is usually done through a committee that develops the curriculum guidelines. At the school level it must be initiated by the principal who then works through a group of teachers to develop an in-school program of studies. Yes, at the classroom level I can do anything that will bolster my students' education.

3. What is a realistic budget? What I would like to have ($30,000), or what is available ($300 per classroom)?

4. The assignment will only become significant if answers to the above questions are taken into consideration.

5. The course of action is dependent on all of the above points.

So, in the following pages I will first discuss the terms "educational computing" and "computer literacy"; then I will discuss curriculum development philosophies and relate them to my present situation. I will also mention the guidelines developed by the provincial Ministry of Education because they must be followed closely in all publicly-funded schools. At this point I will mention the current situation in schools as far as computer usage is concerned. Here I will like to bring into discussion points made by various futurists who have commented upon the rising popularity and desirability of computer knowledge for the younger generations. Then I will develop objectives for the program, followed by an explanantion of what actually happened.

Educational Computing in Schools by Sushil K. Jain

Defining Educational Computing

If we define the term educational computing as all those facets of computer applications that can be utilized in an educational setting, specifically an elementary, junior and/or high school, then we will have to include (i) the use of computers by students in their learning processes; (ii) the use of computers by teachers for reaching the educational objectives of enhancing their students' skills in specific areas, and the use of computers for their own administrative purposes, e.g. record-keeping; (iii) the use of computers by the school office for various administrative tasks, viz. class-lists, bus-lists, newsletters, memos, etc.; and finally (iv) any other use by any member of the school community like students' unions, parent-teacher clubs, library lists, etc.

If this is what we understand by educational computing then it is a very long and complicated assignment. However, if we can limit the term educational computing to computer literacy by/of students or introduction of computers to students for their educational needs, the task might become more manageable though not necessarily easier.

What is Computer Literacy?

The assumption that students will have to acquire "computer literacy" before they leave the educational system is a view that is widely held. However, Ragsdale (1982) points out, there is less agreement on what the definition of computer literacy is, or should be. There does not seem to be any clear-cut definition of computer literacy that is universally accepted. Even the contributors in Taylor's book (1980) seem to ignore the need for a definition but are willing to use other terms such as "education in computer use" to make their point, as does Luehrmann. He would rather consider computers as "not a thing to be taught with, but a thing to be taught *about*. Not a *means*, but an *end*" (p. 137). A definition given by Hunter (1980) is "whatever a person needs to know and do with computers in order to function competently in our information-based society" (p. 1). Unfortunately, Ragsdale (1982) points out, this may change the problem from a definition of one term (computer literacy), to a definition for two terms, "function competently" and "information society." Other authors, like Anderson & Klassen (1981), have defined it as "whatever understanding, skills, and attitudes one needs to function effectively within a given social role that directly or indirectly involves computers" (p.131). Others, like Ershov (1981), see computer programming as the essential component of any literacy program.

One would, however, be well advised to recognize a number of aspects of computer literacy that are being generally agreed upon. Heller and Martin (1982) refer to two National Science Foundation funded projects, directed toward different areas of the computer impact on society. According to NSF, computer literacy involves a knowledge of the following (p. 2):

1. how computers work;
2. step-by-step technique for problem solving;
3. social implications;
4. computer applications; and
5. historical perspective of computers and future trends.

Regardless of whichever definition we accept, the fact remains that schools will have to impart some knowledge about and by computers in the coming years. Says Taylor (1980), "For the foreseeable future, computing will play an increasingly important role in human learning. However, no one yet knows exactly how great that role will eventually be, or precisely what form it will finally take" (p. 1). Bork (1978) is much bolder in predicting the importance of computers in education. He states, "We are at the onset of a major revolution in education, a revolution unparalleled since the invention of the printing press. The computer will be the instrument of this revolution. While we are at the very beginning - the computer as a learning device in current classes is, compared with all other learning modes, almost non-existent - the pace will pick up rapidly over the next 15 years. By the year 2000 the major way of learning at all levels, and in almost all subject areas will be through the interactive use of computers" (p. 53).

Given the above parameters we will then have to develop a curriculum that will include "Teaching about computers", "Teaching through computers", "Teaching with computers" and all other adjuncts that might crop up from now till tomorrow. We will have to learn to use the computer as a tutor, as a tool, and as a tutee or student. We might even have to include the fourth *I*, i.e. "Computer as a toy" for leisure enrichment activities, as suggested by Taylor (1980).

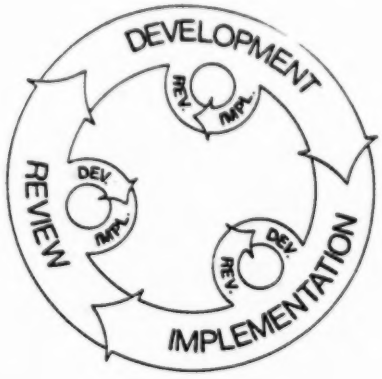
CURRICULUM DEVELOPMENT/PLANNING

"Planning a course of study for pupils, and constructing the curriculum they follow," advocates Philip Taylor (1970), "is central to the whole educational process. Upon this planning hinges a very great deal. It defines, directs and co-ordinates what the pupil is intended to learn, gives direction and purpose to teaching, provides it with a justification

and gives it order and coherence. About how this planning is done, what criteria may best be used to decide between alternative possibilities, and how to judge the effectiveness of the planning, we know next to nothing. In periods of educational continuity such knowledge may be unimportant but in times of educational change when teachers are being called on to develop new approaches to teaching and new courses of study it is likely to be of crucial value ... there is a need to make explicit the principles by which effective planning is achieved, and to communicate these principles so that they may become, in time, part of the professional expertise of all teachers." Quoted by Rowntree (1974), p. 3.

Such a role of educational technology in curriculum development has been elucidated by Derek Rowntree (1974) which was propagated much earlier by Ralph Tyler (1950). Tyler has pointed out that "if an educational program is to be planned and if efforts for continued improvement are to be made, it is very necessary to have some conception of the goals that are being aimed at" (p. 3). He goes on to explain that "curriculum planning is a continuous process and that as materials and procedures are developed, they are tried out, their results appraised, their inadequacies identified, suggested improvements indicated; there is replanning, redevelopment and then reappraisal; and in this kind of continuous cycle, it is possible for the curriculum and instructional program to be continuously improved over the years" (p. 80)

Thus we can see curriculum development is not a one-shot affair. It is a long-drawn-out process which once carefully started has to be observed meticulously through various stages. We can get a glimpse of these processes through the following "flaming donut":



The foregoing diagram was handed out at the Ministry of Education, Province of Ontario, Principals' Course (1984); authors unknown.

There are of course other models for curriculum development and implementation. Rowntree (1974) expands the above three phases of educational technology into four phases as in Figure 1.1; then he expands and elaborates these in Figure 1.2.

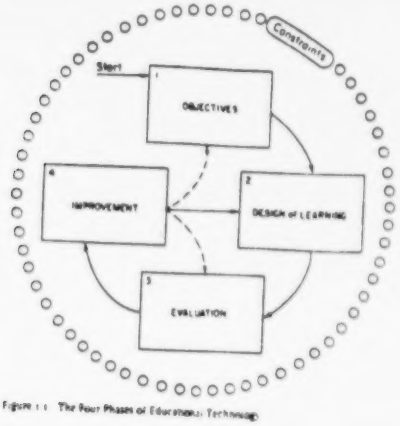


Figure 1.1 The Four Phases of Educational Technology

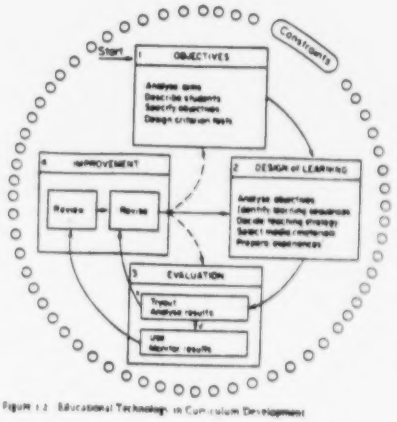


Figure 1.2 Educational Technology in Curriculum Development

Now that we know there have to be some objectives and goals, we have to consider whose goals, whose objectives, or whose needs should be met in these objectives; and should those objectives meet the present or future needs of the students. Toffler (1970), for example, has suggested scrapping of a substantial part of the formal curriculum if it cannot be strongly justified in terms of the future (p. 351-352). Current curricula must, therefore, meet the needs of the students for the foreseeable future, and must prepare them to meet the future successfully.

One of the goals of educational computing in the classroom should be to prepare children for future times. John Naisbitt (1982) reports that by one estimate, 75 percent of all jobs by 1985 will involve computers in some way - and people who don't know how to use them will be at a disadvantage (p. 27).

But we cannot just tell the children that they need computers and therefore they must study them. Computers have to be introduced properly into the classroom and not suddenly as Jane Brown (1985) did. She described her experience as follows:

"The first mistake I made was arriving in the classroom one morning with a small computer terminal, a portable monitor, and an armful of assorted electrical cords.

"Today", I announced proudly, "I have a surprise for you. We are going to learn all about word processing!"

The students looked stunned.

Unable to determine why my class appeared disgruntled, I compounded my initial error by beginning what I was later to call 'The Teacher and Computer Show', a fast presentation of the techniques involved in word processing on the computer. During that seemingly endless hour, I realized to my dismay that my enthusiastic demonstration of the wonders of electronically-aided composition was being received not with interest, but with apprehension bordering on hostility. The more I praised the computer as a means of writing better, the further the students scrunched down in their desks, arms folded, eyes defiant.

I doubled my efforts to be encouraging. "You will be amazed at what the word processor can do to help your writing," I concluded.

A student at the back of the classoom shifted her desk and planted her elbows firmly on the desk top. "You could be right," she said in a discouraging tone. "But what's going to help me use a word processor? Except for arcade games, I have never touched a real computer in my life, except for the one at home hooked to the TV!" (p. 12).

We must, therefore, pay some heed to the progressive educational philosophers, who as Tyler (1950) points out, emphasize the importance of studying the child to find out what kind of interests he has, what problems he encounters, what purposes he has in mind (p.4). The same viewpoint is presented by Vanderburg (1985). Although, he says, paradigms are self-organizing, learning can be effective only when a person is presented with new material in a certain way or when he has learned to organize it himself. Sound teaching begins with something with which students are familiar. It then goes on to new material which is added to their structures of experience via existing paradigms. The process continues in a step-by-step fashion, since the teacher cannot assume any flashes of inspiration on the part of the students. This sequence of learning operations involves the expansion of existing paradigms and concepts or the creation of new ones. Failure to understand something occurs when a student can no longer relate it to his structure of experience (p. 212).

The argument for considering the needs of the students as an important source for educational objectives has been given by Tyler (1950) as follows:

> The day-to-day environment of young people in the home and in the community generally provides a considerable part of the educational development of the student. It is unnecessary for the school to duplicate educational experiences already adequately provided outside the school. The school's efforts should be focussed particularly upon serious gaps in the present development of the students (p. 6).

The question then that arises in front of us as educators is: "Are the needs of the students for computer literacy being met outside the classroom?" The answer is obviously no. Though there are many homes where there are computers hooked to the family TV, few students are getting the "proper" grounding in the uses and possibilities of computers, and its impact on their lives and society in general. If we can assume that students' needs in computer usage and applications are not being met at home, then we have to consider if their needs are being adequately met in their schools?

In the absence of any national survey in Canada - education being a provincial matter - we can only come to a certain conclusion by reading the literature from various provinces that students' needs are not being met satisfactorily. Jocelyn Berthelot (1986), while commenting on the findings of a large survey investigation involving some 5,000 Quebec teachers, says:

> "Only a small number of teachers have so far been involved with the use of microcomputers in Quebec clasrooms."

Gail Caissy (1987) has commented upon the biggest problem plaguing the field of educational computing. It is, she says, a lack of sufficient hardware to satisfy the needs of both teachers and students. Although a growing number of schools now have a computer lab available for general use, there are still schools with no computers at all and those just making their first computer purchase (p. 8)

SITUATION IN HOME PROVINCE

From all the evidence we can gather from newspaper reports, magazine articles, scholarly journals and Ministry of Education reports, one can only come to the conclusion that while there is a lot of hoopla and verbal rhetoric, very little is being done in a systematic fashion to introduce computer technology in Ontario schools. In a study prepared for the Ministry of Education, Province of Ontario (1983), the researchers found:

1. More than half the schools had only one or two micros. Almost three-quarters of the total number had been obtained in 1981 or 1982.

...

4. Schools reported that they planned to use the micros mostly for enrichment programs, with remedial and special education programs to receive a lower priority.

5. The general consensus of teachers was that it took a great deal of time to learn to use the micro properly and even highly motivated teachers expressed frustration related to time.

...

7. With so few machines available, pupils take turns, share, cooperate, and teach each other; they do not consider using micros as work but instead regard this activity as entertainment and fun.

Obviously there has not been "full funding" of computer hardware and software by the Ministry of Education and the school districts are hamstrung to provide any substantial funds across the board. Moreover, for fears of discrimination charges, the county boards or school districts are unwilling to consider furnishing one school at a time with a computer lab with thirty or more computers.

Even when educational authorities are reluctant to put money into computers, as they have been in British Columbia, reports Karen Howlett (1986), Canadian parents have shown a determination not to be denied. Parent-teacher clubs have been raising funds for computers through bake sales, hot-dog days, casino nights and whatnot.

Parents, some enthusiastic educators, and many journalists are convinced that use of computer technolgy is on the way up and that all students must master this art/science. Computer manufacturers seem to have convinced many parents that if their children do not have a computer at home they may be left behind in the race towards computer literacy.

How prevalent this point of view is can be discerned from the pieces of advice that were given to Cynthia Macdonald when she wrote to the editors of *Chatelaine* magazine just before the end of 1986. She wrote:

> I am a 22-year-old woman with a newly acquired degree in French and history from a major Canadian university. As such, I'm afraid that I have been approaching graduation and my postgraduation career hunt with an air of desperation. My

> options are many: wife, mother, careerwoman, professional. We already seem to have a surfeit of lawyers and business execs; at the other end of the job spectrum, I can't draw or operate a word processor. Power tools scare me. What should I do with the rest of my life? (p. 76)

Some of the ten prominent Canadians who took time to reply to her letter and offer concrete suggestions said:

"I suggest you pull together and learn to operate a word processor." *Barbara Amiel*, journalist.

"I'm sorry you haven't picked up word-processing skills along the way. Word processing is the typing of the 80's, I suppose, and if what's keeping you from acquiring them is the same reasoning that (justifiably) has kept a lot of bright women from learning typing - if you can do it, you will do it - then, that's not too bad. I finally mastered my own computer when I was 50, and the only thing that keeps me from saying I don't know how I got along without it is that everyone I know is already making the same point." *Peter Gzowski*, broadcaster.

"... I would develop computer/wordprocessing skills so that you can communicate in the modern world. If you can type, then give yourself two weeks to master word processing. If not, allow six weeks. If I could master my Macintosh in two weeks, then computers should present a serious hurdle to no one." *Jack McClelland*, publisher.

In view of this parent and public pressure, the Ontario Ministry of Education (1987) has now come out with some initiatives to promote computer literacy. The Ministry of Education's expectations concerning information technology and its curriculum development initiatives are described below:

1. All students in Ontario schools shall have the opportunity, to the full extent of their abilities, to become knowledgeable and creative in their use of computers as personal tools. Educators developing curriculum for children in the Primary and Junior Divisions shall therefore include computer applications, where appropriate, in the areas of study defined in The Formative Years. Educators developing courses of study for all subjects offered in the Intermediate and Senior Divisions shall also incorporate computer applications, where appropriate.

2. Ontario's curriculum policy reflects the need for flexibility and autonomy in learning. Computers can be used to support this policy; teachers are expected to keep its implications in mind when choosing and designing computer activities for their students. Students should be given opportunities to use computers in a variety of activities, such as drawing, writing, composing, exploring, calculating, analysing, role-playing, and accessing information resources. This can be accomplished through the use of word processors, simulation programs, graphic editors, sound editors, spreadsheets, database managers, and telecommunication media. Students should explore the ways in which network configuration can provide a medium of communication and collaboration with peers and teachers both within and outside the school. Students should come to see the computer as a self-help tool of everyday life (p. 1-2).

These philosophies expressed above are basically the same as expressed by Thomas Sobol and Robert Taylor (1980) in describing the Scarsdale, New York, project to integrate computers into the K-12 curriculum. They speak of computers as tools to transform the schools from kindergarten upwards and advocate that pupils should begin learning about computers and computing from the time they enter school and should continue such learning through the grades.

It is thus in these assumptions and guidelines that we prepared the following curriculum for our grade 5 class, which is in an elementary public school from K-8. Since children of any particular grades will have varying capabilities in computer usage we will try to individualize many of these activities and assignments. We are greatly indebted to works of people like Heller and Martin (1982), on whose expertise we were able to draw up the following program.

Educational Objectives for Computer Literacy

1. What is Computer Literacy?

The student will be able to:
-Define computer literacy.

2. What do people think about computers?

The student will be able to:

-Describe his/her own conception about computers, including what it does as well as what it looks like.
-Read a report on computers as represented in fiction.
-Discuss personal attitudes towards computers.

3. Where did computers come from?

The student will be able to:

-Realize the recent growth of computer development.
-Identify the accomplishment of several men and women in the field.
-Enumerate the major watersheds of computing history.
-Make a simple counting device.

4. How do computers work?

The student will be able to:

-Name the five major parts of a computer.
-Explain the function of each of the five parts of the computer.
-Discern whether or not a problem is sufficiently well defined to be solvable.
-Define a problem sufficiently for problem solving techniques.
-Apply the problem solving technique to a problem of daily activity.
-Apply the problem solving technique to a math or science problem.
-Explain how a problem is presented to the computer through a special language called a programming language.
-Understand that there is a hierarchy of computer languages.
-Describe how a computer executes a program.
-Write a simple program.
-Learn the use of flowcharts.

5. What do computers do for us?

The student will be able to:

-List numerous areas of uses of computers.
-Name one or more specific applications in each area.
-Describe one application completely including the purpose for using the computer, the environment, the cost, the impact.
-Make at least one visit to see a computer application in action.
-Understand the concept of GIGO.
-Use LOGO/POGO.

-Use Koalapad.
-Study PASCAL for enrichment.

6. Where do we fit into the computer picture?
The student will be able to:
-Identify jobs in the computer industry.
-List the skill level required for these jobs.
-List the educational and training requirements for these jobs.

7. How will computers affect our lives?
The student will be able to:
-Define the terms: privacy, automation, data bank, computer crime.
-Discuss the pros and cons of a cashless society.
-Define and discuss artificial intelligence.
-List areas in which computers will play a major role in the future.

8. How to operate a micro?
The student will be able to:
use the micro independently by knowing how to:
-turn ON the computer
-use LOAD, RUN commands
-use the SPACEBAR, RETURN and INST/DEL keys
-keyboard effectively and accurately with speed
-use the computer as a calculator
-take care of the floppy disks.

9. How are personal computers/micros being used and for what?
The student will be able to use programs like:
-word processing for personal writing
-practice Storywriter, Paperclip
-learn right justification
-practice SAVE command
-learn how to set TABs
-practice boldfacing, underlining techniques
-printing with different pitches

-spreadsheets for solving some math questions
-data base for making lists, bibliographies
-telecommunication for connecting to Ontario networks like York University Freeaccess network
-software evaluation.

Let's take now a realistic and optimistic look at three issues that a teacher will have to deal with while implementing such a program. They fall into the following categories: (1) Hardware, (2) Software and (3) Somewhere.

We will deal with each of these issues one by one.

1. Related to the question of hardware is the question of technical needs which should be considered before the computer equipment is set up. These matters should be of particular concern:

-electrical requirements
-power points
-the carts or desks that computers will be set on
-chairs, stools for users to sit on which are comfortable and at their eye level.

2. The question of software is very crucial if the computers are to be used to meet the educational objectives set in this paper. Much of the software that we can use will of course be public domain and be distributed and approved by the district/board office. It comes mainly from Windsor Softshare, London Board, PET educators group, and Peel County Board of Education. There are some, but not many, commercially produced software programs like PaperClip and MasterType that we own privately which can be used in the classroom. Before purchasing, or recommending purchases in the resource center, one should be aware of many points raised by Walker and Hess (1984) and Heck, Johnson and Kansky (1981) in selecting commercially produced or publicly available programs. There are also Canadian journals like Software Now and Computers in Education that can be relied upon for good suggestions.

3. The last issue, but not the least, is related to the physical arrangement of equipment which we will call "put it SOMEWHERE." Physical arrangement is as important as the above two points, because if machines are not properly housed they can cause the teacher a great deal of hassle and chaos in the classroom. To avoid any wastage of time for

either teachers or students, we must make sure that the computers and computer courseware are placed conveniently.

There is not enough space here to draw plans or locations of various pieces of equipment. Since there are going to be over thirty students in the classroom, there will not be enough room to locate all the computers that are at my disposal. Our school has 6 PET's, three C-64's and two printers. I have my own computer and printer in school. By a special arrangement with the principal and staff, I can have access to at least 4 computers for part of a day, and all the computers on one day in the 7-day cycle. Our school-year runs on a 7-day cycle. Since there are usually 185 teaching days in a school year I can reserve all computers for 26 occasions during the academic year, but some of the days will be used up by whole-class instruction or demonstration. The computers will be located outside the classroom in the hallway where there are enough electrical outlets. The only problem is that this is a traffic area and can be distracting to many a student.

The first week will be spent explaining the objectives, and what I expect them to get out of this program. We will talk, share pieces of information, and fill out a few questionnaires to provide a means for testing their attitudes about computers, and to identify students' strengths and weaknesses in their knowledge about computers.

Still as a whole class, the next week I will show TVOntario's program, *Bits and Bytes*. It is about 15 minutes long per episode. Following a short discussion on the show or any other issue, I will try to emphasize the need for becoming an adept keyboarder. I will hand out a keyboard diagram and advise them to be ready to practice keyboarding skills next week. Before the next week arrives I will choose a student monitor or two who will be reliable enough to work as group leaders for students working at the computers. I will teach the monitors one step in advance.

Third week, we will review the keyboarding skills and allow one half of the class, in pairs, to try out a "Typewriting" program on the computers. The rest of the class will watch the video program and engage in discussion.

Following the above pattern, the students will receive at least one weekly lesson on computer literacy on the topics mentioned earlier in this paper. For the rest of the week, computers will be available for students to keyboard in their stories according to a timetable posted on

the bulletin board. Each student shall get at least one turn per week or not less than an hour and not more than an hour and a half on the computer to type his/her personal writing, revise and improve it with the aid of a fellow student or monitor and save it for printing. Computers will be used accordingly for math and social studies.

This is how educational computing was introduced to one class of grade 5 students with limited success. The problem was that I was in the portable (separate room outside the school) and setting up the computers took a long time. It was extremely difficult when the teacher was on yard duty during the noon hour or when the student helper was sick or did not arrive to set up the computers on time. The computers were stored overnight with the resource withdrawal teacher whose room was about 30 to 40 metres away from the place where the computers could be set up. Movement of the computers made a terrible noise because they were on coasters attached to wooden desks. There was always the fear of an accident - computers being dropped from the desks during movement. Then there was the job of unplugging and returning the computers to the place of borrowing. Once a computer remained on for the whole evening and night, because the teacher had to go to a meeting at another school before school finished. Nobody noticed that the computer was on.

There have been other problems, like that of dust and the saving of students' texts over computer programs (we still use cassette recorders for all PET's except C-64's). The ideal solution is to have a room where the computers will remain permanently and we can have a computer coordinator. However, that will mean releasing a teacher and having bigger classes. No teacher wants that. So I must continue to implement educational computing alone as best as I can.

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